

## Increased lifetime of hydrogen-like $^{192\text{m}}\text{Os}$ observed in the ESR\*

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Using the Experimental Storage Ring (ESR) it is possible to distinguish between charge states of an isotope with sensitivity down to single ions [1]. Projectile fragmentation of a  $^{197}\text{Au}$  beam (478–492 A·MeV) with a  $^9\text{Be}$  target was performed and the resultant fragments were passed through the FRagment Separator [2] where isotopes of interest were separated before being injected into the ESR. The ions were cooled by electron and stochastic cooling enabling Schottky Mass Spectrometry to be used and nuclear decays within the ESR are inferred from changes in ion revolution frequency [3].

Prior studies of  $^{192}\text{Os}$  revealed an isomer with a lifetime of  $\tau_{\text{neut}} = 8.5(14)$  s at 2015 keV. Three decay branches have been observed with transition energies of 47, 302, and 307 keV [4]. Neutral [5] and hydrogen-like internal conversion coefficients were calculated and indicate a decrease for all transitions (Table 1). For the 47 keV transition internal conversion in the hydrogen-like state is forbidden. An increased lifetime of  $\tau_{\text{calc}} = 13.0(24)$  s due to the reduction of internal conversion can be expected.

Table 1: Calculated total internal conversion coefficients for transitions from  $^{192\text{m}}\text{Os}$  [4, 5].

$E_{\text{trans}}$	$I_{\gamma}$	$\sigma\lambda$	$\alpha_{t(\text{neut})}$	$\alpha_{t(\text{H-like})}$
47.4	0.0031(6)	E3	7760	0
302.6	100(6)	E3	0.433	0.084
307.0	13.3(3)	M2	0.975	0.374

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An increased lifetime for  $^{192\text{m}}\text{Os}$  was measured from observations of 106 single hydrogen-like ions in the ESR (Figure 1). After Lorentz correction ( $\gamma = 1.4$ ) the measured mean lifetime of  $^{192\text{m}}\text{Os}^{75+}$  was  $\tau_{\text{Lorentz}} = 14.2(16)$  s. The observed increase in lifetime is attributed to the reduction of internal conversion because of the high charge state.

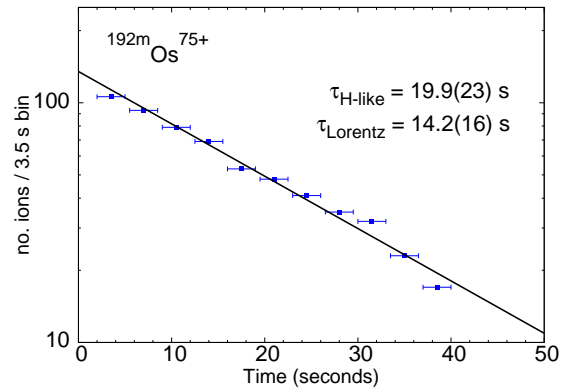


Figure 1: Lifetime curve for  $^{192\text{m}}\text{Os}^{75+}$  produced by direct observation of highly charged single ions in the ESR.

## References

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